

# Towards Efficient Viscous Modeling Based on Cartesian Methods for Automated Flow Simulation, Phase I

Completed Technology Project (2009 - 2009)



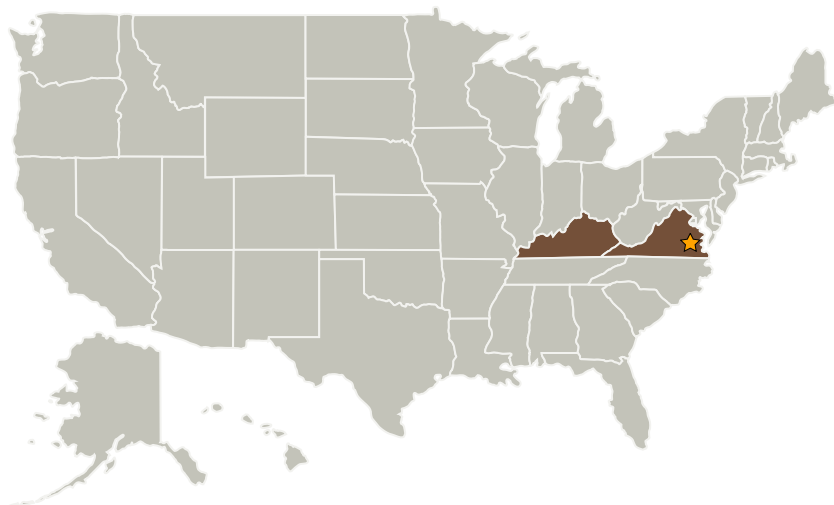
## Project Introduction

The proposed work aims at developing techniques that will address the current limitations of Cartesian-based Navier-Stokes CFD schemes by exploring three promising methods of implementing improved wall boundary conditions. The three methods are based on: (1) the diamond stencil approach of Delanaye et al., (2) the extrapolation boundary condition work by Marshall and Ruffin, and (3) the Material Point Method developed by Advanced Dynamics. The knowledge gained from prototype implementations of these schemes will lead to the development of an efficient viscous modeling algorithm suitable to general Cartesian CFD codes at the end of Phase I. Phase II will integrate this algorithm into a large-scale Cartesian CFD code in consultation with NASA technical representative. Phase III will commercialize the resulting techniques to be developed in Phases I and II and demonstrate their applicability to a wide range of problems.

## Anticipated Benefits

Various DoD components likely to have an interest in the technology include Air Force, Navy and Army. Non-military applications represent another opportunity for sales. The development of viscous modeling methodologies and algorithms for Cartesian-based solvers should be of interest to a wide range of aerospace and ocean applications. Potential clients include Boeing, Pratt & Whitney, General Electric, General Dynamics, Lockheed Martin, Textron, and others. In addition, corresponding companies in Europe and Asia represent a very large potential market for the resulting methodologies and algorithms.

## Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★ Langley Research Center (LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Advanced Dynamics, Inc.	Supporting Organization	Industry Minority-Owned Business	Lexington, Kentucky

Primary U.S. Work Locations	
Kentucky	Virginia

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Langley Research Center (LaRC)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Project Manager:**

Michael J Aftosmis

**Principal Investigator:**

Patrick Hu

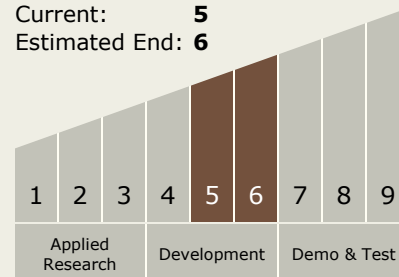
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## Technology Maturity (TRL)

Start: **5**  
Current: **5**  
Estimated End: **6**



## Technology Areas

### Primary:

- TX15 Flight Vehicle Systems
  - └ TX15.1 Aerosciences
    - └ TX15.1.3 Aeroelasticity